LEEDS AND NORTHRUP

PLATINUM-PLATINUM RHODIUM

THERMOCOUPLES

Western Electric Company

ENGINEERING RESEARCH CENTER

LEEDS AND NORTHRUP

PLATINUM-PLATINUM RHODIUM

THERMOCOUPLES

DIRECTIONS

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Instruction Booklets

PLATINUM-PLATINUM RHODIUM THERMOCOUPLES

8700-□
8700-B-□
8702-□
8702-B-□
8703-□
8710-K2002-□-□
8710-B-K2002-□-□
8710-K2025-□-□
8710-B-K2025-□-□

LEEDS NORTHRUP
PHILADELPHIA 44, PA.

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PLATINUM-PLATINUM RHODIUM THERMOCOUPLES

8700-□	8702-B-□	8710-B-K2002-□-□
8700-B-□	8703-□	8710-K2025-□-□
8702-□	8710-K2002-□-□	8710-B-K2025-□-□

1. GENERAL INFORMATION

A. General Description

In the 8703-□ Thermocouples, the Platinum Rhodium wire is composed of 87% Platinum and 13% Rhodium while in the remainder of the thermocouples, listed in the title, this wire is composed of 90% Platinum and 10% Rhodium.

A commercial grade of 24 B&S gage wire is used in the 8702-□ and, while it is quite suitable for most commercial measurements, it is not suitable for use as a standard. On the other hand, a premium grade of 24 B&S gage wire is used in the remainder of the thermocouples, listed in the title, and they are suitable for use as standards. However, an L&N® Certificate of Accuracy is furnished only with the thermocouples having the letter B in the catalog number, i.e., 8700-B-□.

This difference, in grade of wire, accounts for the difference in limits of error listed in Section 1C.

All the thermocouples, listed in the title, are strung through suitable insulators and inserted in a refractory type (L&N Fyrestan) primary protecting tube with a head mounted on the end of the tube for the wiring connections. The various assemblies are described in Section 1B.

Although secondary protecting tubes are sometimes used, the catalog numbers listed in the title do not include such tubes and they are, therefore, not covered in these directions.

Some of the catalog numbers, in the title, contain one □ while others contain two (□-□). Where there is only one □, it represents the specified length of the primary protecting tube, i.e., 12 inches to 48 inches in increments of 6 inches. Where there are two, the first represents the specified length of the protecting tube while the other represents the distance the thermocouple wires extend beyond the head on the protecting tube as indicated by A in Figs. 3 and 4.

B. Description of Assemblies

(1) 8700-□ and 8700-B-□

The assembly for these thermocouples is shown in Fig. 1.

The thermocouple wires 3, extend up through insulators 5, spacer 4 and fish spine insulators 2 (for flexibility), and are clamped under the screws of the terminals in the head. These terminals extend through the head. The hole and clamping screw, in each terminal, are for connecting the leadwires to the thermocouple.

The thermometer 8, mounted in a protecting sheath, extends into the head to measure the temperature at this point (reference junction) when copper wire is used for the connections to the thermocouple. This is described in more detail in Section 3D.

(2) 8702-□, 8702-B-□ and 8703-□

The assembly for these thermocouples is shown in Fig. 2.

This arrangement is the same as described for Fig. 1 except the thermometer is omitted.

(3) 8710-K2002-□-□ and
8710-B-K2002-□-□

The assembly for these thermocouples is shown in Fig. 3.

The thermocouple wires 3, extend up through insulators 5, spacer 4 and fish spine insulators 2 (for flexibility). They are then twisted once around the clamping screws in the terminals in the head, clamped in place by these screws (and washers) and carried up through the holes in the head. Then fiberglas tubing is fitted over each wire at 9.

Connections to the thermocouple should be made to the wires at 9.

(4) 8710-K2025-□-□ and
8710-B-K2025-□-□

The assembly for these thermocouples is shown in Fig. 4.

The only differences between this assembly and the one shown in Fig. 3, are the protecting tube 7 is smaller in diameter and because of this, spacer 4 is up in the head since the tube is too small to permit it to enter. Thus, the flexible fish spine insulator section 2 is shorter than in Fig. 3.

C. Limits of Error

Thermocouples	Temperature Range	Standard Limits of Error
8702-□	0-1000 F 1000-2700 F	±5 F ±0.5%
All others listed in the title	0-1000 F 1000-2700 F	±2.5 F ±0.25%

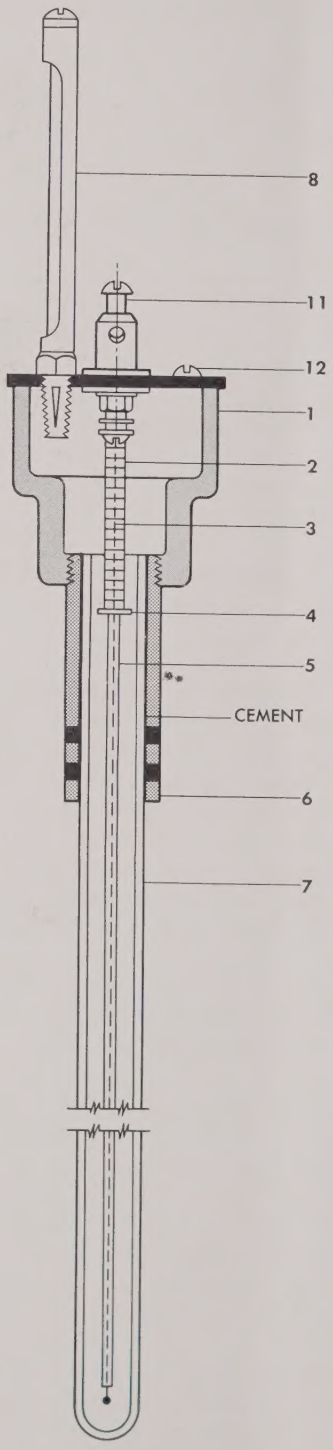

Fig. 1—View of 8700-□ and 8700-B-□ Thermocouples.

Where the limit of error is expressed in per cent, the limit of error is a percentage of the temperature reading, not of the range.

The thermometer mounted in the head of the 8700-□ and 8700-B-□ thermocouples has a range of 0 to 60 C with the scale marked for every 2 degrees. Thus, the limit of error within which it can be read might be as much as ±2 C. Any error in this reading would affect the thermocouple reading only when the reference junction is at the thermocouple head.

D. Temperature Limit

It is to be noted, from the limit of error table, that the maximum temperature to be measured with these thermocouples is 2700 F.

2. INSTALLATION

The preferred method of mounting these thermocouples is to have them in a vertical position with the end of the protecting tube pointed down. This places the minimum strain on the tube and thermocouple element at elevated temperatures. However, they may be mounted in the most convenient position so long as no external mechanical strain is involved.

When used as a standard, the thermocouples to be checked with the standard should be placed parallel to the standard and in close proximity to it and all in a vertical position with the tube ends, measuring junctions, pointing down.

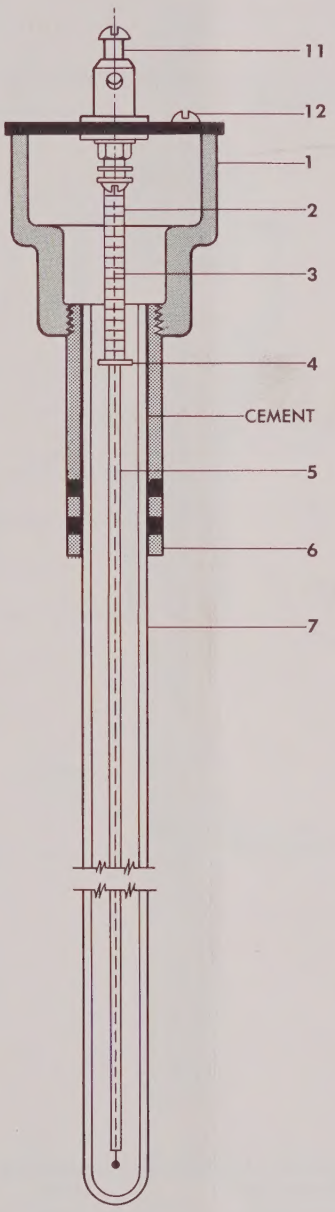

Fig. 2—View of 8702-□, 8702-B-□, and 8703-□ Thermocouples.

3. WIRING CONNECTIONS

A. General Information

The Platinum wire of the thermocouple is negative (-) while the Platinum Rhodium wire is positive (+) and their respective terminals of the assemblies are marked accordingly.

The L&N duplex leadwire for use with these thermocouples has a copper

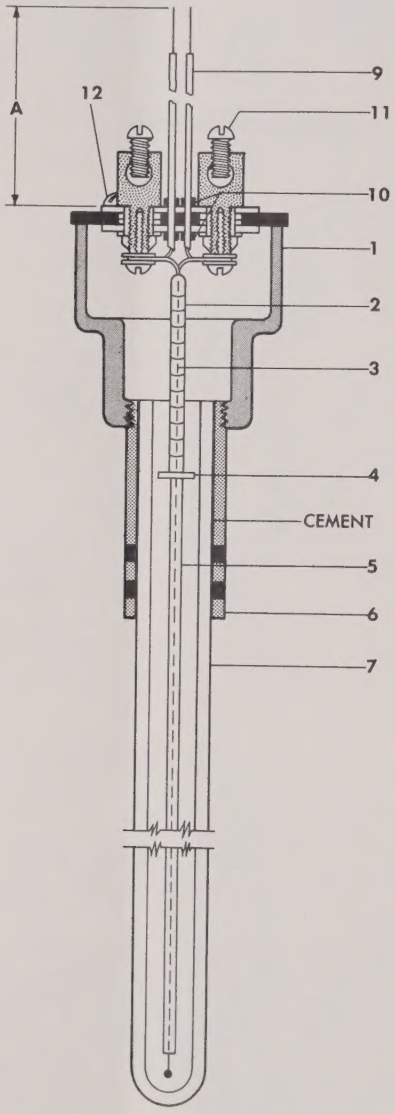

Fig. 3—View of 8710-K2002-□-□ and 8710-B-K2002-□-□ Thermocouples.

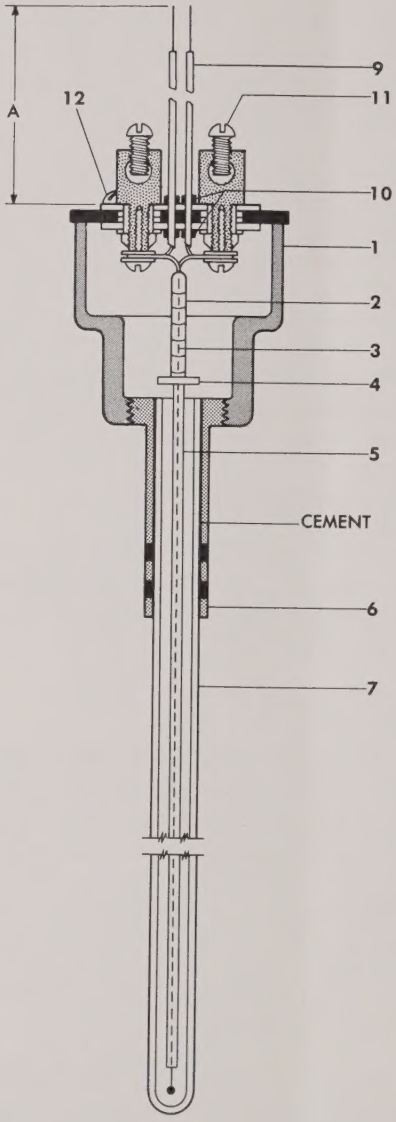

Fig. 4—View of 8710-K2025-□-□ and 8710-B-K2025-□-□ Thermocouples.

wire, with black insulation, for the positive (+) connection a wire which is an alloy, with red insulation, for the negative (-) connection.

The measuring instruments shown in Fig. 5 may be recorders or indicators. For location of terminals, temperature compensators, etc., and for method of operating and adjusting, refer to the directions for the specific instrument.

Any of the thermocouples, listed in the title, can be used in any of the combinations shown in Fig. 5.

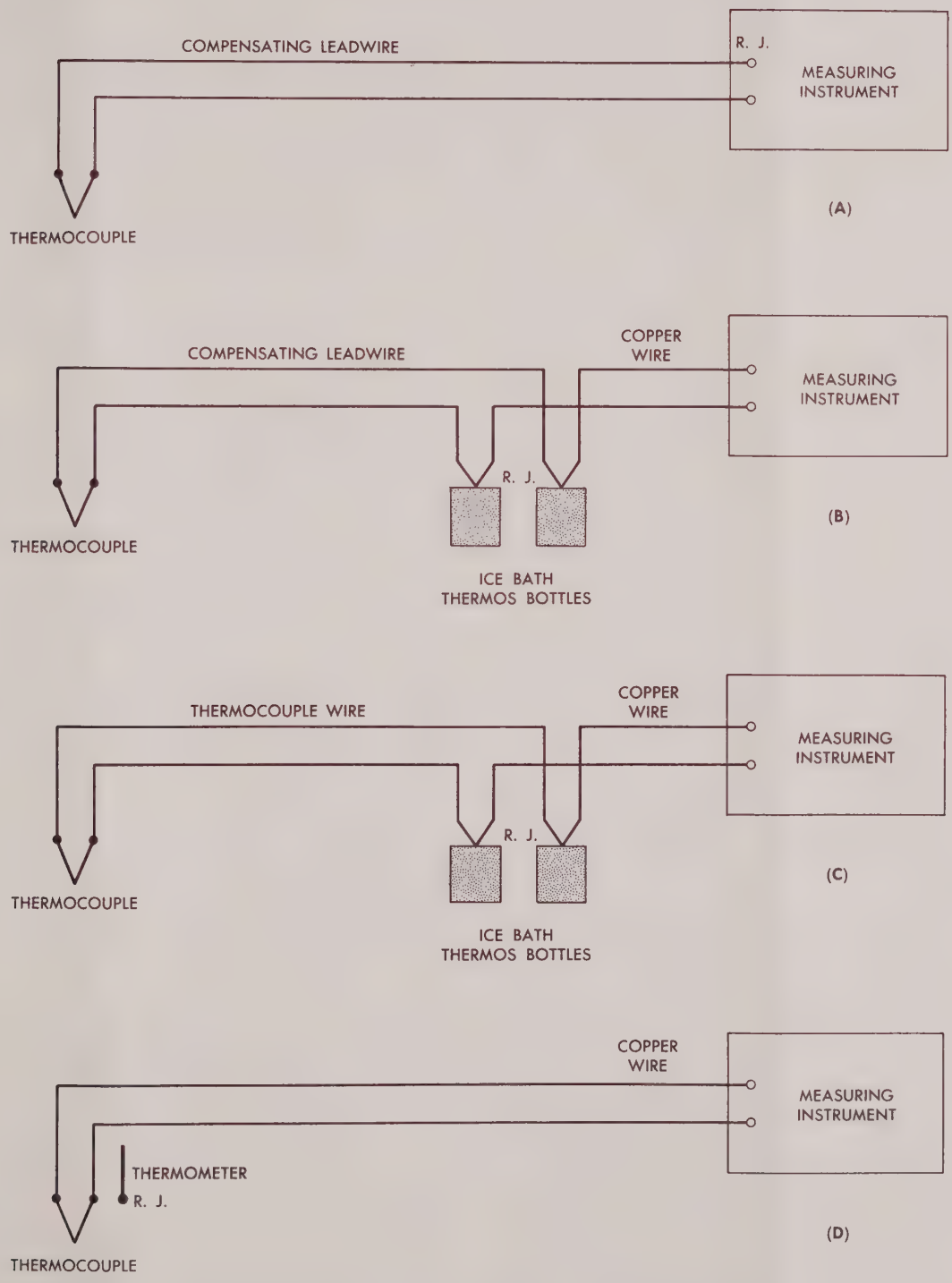

Fig. 5—Thermocouple wiring connections for various types of wire.

However, only the 8700-□ or 8700-B-□ can be used as in Fig. 5(D) as it is the only one equipped with a thermometer in the head.

When using an ice bath for the reference junction, as in Fig. 5(B) and (C), a separate thermos bottle, filled with crushed ice and water, should be used for each lead. Also, be sure that the wire from the thermocouple is solidly clamped to the wire from the measuring instrument before this junction is placed in the thermos bottle.

The thermos bottle should be deep enough to permit the junction to be immersed to a depth of at least 4 inches. The spaces between the ice particles must be filled with water (no air pockets) and the ice must extend all the way to the bottom of the thermos bottle, water being drawn off with a syringe from time to time and ice added and tamped down around the junction and wires as needed.

When the connections shown in Fig. 5(B), (C), or (D) are used, the measuring instrument must have a manually operated temperature compensator.

B. Reference Junction in Measuring Instrument

(1) Automatic Reference Junction Compensator

This condition is shown in Fig. 5(A) where the thermocouple is connected directly to the measuring instrument by means of compensating leadwire. Connect the copper (+) leadwire between the positive (+) terminals of the thermocouple and the measuring instrument and connect the alloy (-) leadwire between the negative terminals of these two units.

Make the necessary adjustments to the measuring instrument to obtain a reading, in millivolts or temperature. If the reading is in millivolts, the proper conversion table (millivolts to temperature) must be used to obtain the temperature reading.

(2) Manual Reference Junction Compensator

The wiring connections in this case are the same as described in Section 3B(1).

However, in operating the measuring instrument, it is necessary to use a good thermometer and measure the temperature at the terminals of the measuring instrument to which the thermocouple is connected. Then set the manual compensator dial to this temperature or at the corresponding millivolt value.

The measurement of the thermocouple temperature is the same as described in the last paragraph of Section 3B(1).

C. Reference Junction at Ice Bath

(1) With Compensating Leadwire Extension

This condition is shown in Fig. 5(B).

Use compensating leadwire from the thermocouple to the ice bath and copper wire from the ice bath to the measuring instrument.

Prepare the ice bath and the junction of wires for the ice bath as described in Section 3A.

The reference junction temperature in this case is, of course, 32 F (0 C) and the temperature compensator of the measuring instrument should be

set at this value or at the corresponding millivolts value if the compensator is calibrated in millivolts.

The measurement of the thermocouple temperature is the same as described in the last paragraph of Section 3B(1).

(2) With Thermocouple Wire Extension

This condition is shown in Fig. 5(C).

This is the same as the condition described in Section 3C(1) except that the thermocouple wires are extended to the ice bath. In other words, the thermocouple wires were supplied long enough to be used in this manner.

D. Reference Junction at Thermocouple

This condition is shown in Fig. 5(D). Where copper wire is used to connect both terminals of the thermocouple to the measuring instrument.

In this case, the reference junction is at the terminals (head) of the thermocouple. Measure this temperature on the thermometer in the head of the thermocouple and set the compensator in the measuring instrument at this value.

The measurement of the thermocouple temperature is the same as described in the last paragraph of Section 3B(1).

4. MAINTENANCE

A. Replace Thermocouple Element

(1) For 8700-□, 8700-B-□, 8702-□, 8702-B-□ and 8703-□

Loosen the two screws 12, Fig. 1 or 2. Pull on the cover of the head to remove the attached thermocouple element, which consists of wires 3, insulators 2 and 5 and spacer 4, from the protecting tube. Disconnect the wires from the terminal screws and remove the element from the head.

The wires of the new element are tagged + and -. Connect them under the screws of the respective terminals in the head. These terminals are marked + and - on the top of the head cover. Insert the new element into the protecting tube, fit the cover in place on the head and tighten screws 12.

(2) For 8710-K2002-□-□, 8710-B-K2002-□-□, 8710-K2025-□-□ and 8710-B-K2025-□-□

Loosen the two screws 12, Fig. 3 or 4. Pull on the cover of the head to remove the attached thermocouple element, which consists of wires 3 and 9, insulators 2 and 5 and spacer 4, from the protecting tube. Remove the fishcord at 10 and pull off tubing 9 (or cut the wires off close to the top of the cover). Pull the wires back through the holes in the cover, detach them from the screws in the terminals and remove the element from the head.

The wires of the new element are tagged + and -. Wrap these wires once around the screws (between the washers) of the respective terminals in the head as shown in Fig. 3 or 4 and tighten the screws.

Insert the wires through the holes in the cover as in Fig. 3 or 4 and slip the fiberglas tubing over the wires and down through the holes. Use fishcord and bind each wire on both sides of the cover as in Fig. 3 or 4. Then insert the new element

into the protecting tube, fit the cover in place on the head and tighten screws 12.

B. Replace Protecting Tube

The method for replacing a protecting tube is the same for all thermocouples listed in the titles. A replacement tube includes sleeve 6 cemented to the refractory tube 7.

Remove the thermocouple element as indicated in Section 4A. Then unscrew the head 1 from sleeve 6. Screw the head in place on the sleeve of the new unit and replace the thermocouple element as indicated in Section 4A.

C. Replace Thermometer on 8700-□ or 8700-B-□

To remove the thermometer, simply remove the screw from the top of the sheath around the thermometer and slide the thermometer up out of the sheath. Replace it in the reverse order being sure that the scale is visable before replacing the screw in the top of the sheath.

5. REPLACEMENT PARTS

The replacement parts are given in Tables 1, 2 and 3. For symbol designations, refer to Figs. 1, 2, 3 and 4.

CAT. NO.	SYMBOLS AND L&N PART NOS.				
	1	2, 3, 4 & 5 Combined	2, 3, 4, 5 & A Combined	6 & 7 Combined	8
8700-*	P.I. 143	Std. 780-F-*	- -	K2002-*	Std. 916
8700-B-*	P.I. 143	Std. 784-*	- -	"	Std. 916
8702-*	P.I. 142	Std. 780-*	- -	"	- -
8702-B-*	P.I. 142	Std. 784-*	- -	"	- -
8703-*	P.I. 142-1	Std. 779-*	- -	"	- -
8710-K2002-*-Δ	Note 1	- -	Note 2	"	- -
8710-B-K2002-*-Δ	"	- -	"	"	- -
8710-K2025-*-Δ	"	- -	"	K2025-*	- -
8710-B-K2025-*-Δ	"	- -	"	K2025-*	- -

Table 1

CAT. NO.	SYMBOLS AND L&N PART NOS.			
	9	10	11	12
8700-*	- -	- -	R-53-U	3/8" 6-32 R.H.B. N.P.
8700-B-*	- -	- -	"	"
8702-*	- -	- -	"	"
8702-B-*	- -	- -	"	"
8703-*	- -	- -	"	"
8710-K2002-*-Δ	Note 3	Note 4	"	"
8710-B-K2002-*-Δ	"	"	"	"
8710-K2025-*-Δ	"	"	"	"
8710-B-K2025-*-Δ	"	"	"	"

Table 2

THERMOCOUPLE WITHOUT INSULATORS	
CAT. NO.	THERMOCOUPLE L&N PART NO.
8700-*	Note 5
8700-B-*	Std. 784-A-*
8702-*	Std. 780-A-*
8702-B-*	Std. 784-A-*
8703-*	Std. 779-A-*
8710-K2002-*-△	Note 5
8710-B-K2002-*-△	"
8710-K2025-*-△	"
8710-B-K2025-*-△	"

Table 3

*Add length of protecting tube, in inches (12, 18, 24, 30, 36, 42 or 48).
△Add length of thermocouple wires designated by A in Fig. 3 or 4.

Notes:- 1. Specify: Head for (give complete Cat. No. of assembly).
2. Specify: Thermocouple, with insulators strung, for (give complete Cat. No. of assembly).
3. Specify: Length (in inches or feet) of Insul Flex Tube, Fiberglas, No. 20 Black, L&N Part No. 11.28-1.
4. Specify: Fishcord for use with (give complete Cat. No. of assembly).
5. Specify: Thermocouple, without insulators, for (give complete Cat. No. of assembly).

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BUFFALO 15, 3685 Harlem Road	Atwater 8900
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